

3456789012 02 AUG 2001

FORM PTO-1390

U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE
TRANSMITTAL LETTER TO THE UNITED STATES
DESIGNATED/ELECTED OFFICE (DO/EO/US)
CONCERNING A FILING UNDER 35 U.S.C. 371

ATTORNEY'S DOCKET NUMBER:
980166US/II

U.S. APPL. NO. (if known, See 37 CFR 1.5)

097890583

INTERNATIONAL APPLICATION NO.:
PCT/SE00/00113

INTERNATIONAL FILING DATE:
20 JANUARY 2000

PRIORITY DATE CLAIMED:
2 FEBRUARY 1999

TITLE OF INVENTION: LIQUID SEPARATOR WITH HOLDER UNIT

APPLICANT(S) FOR DO/EO/US: Anders ECKERBOM and Per LINDESTAM

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☒ This express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).
4. ☒ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. ☒ A copy of the International Application as filed (35 U.S.C. 371(c)(2))
 - a. ☒ is transmitted herewith (required only if not transmitted by the International Bureau).
 - b. ☐ has been transmitted by the International Bureau. (see attached copy of PCT/IB/308)
 - c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☐ A translation of the International Application into English (35 U.S.C. 371(c)(2)).
7. ☐ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3)).
 - a. ☐ are transmitted herewith (required only if not transmitted by the International Bureau).
 - b. ☐ have been transmitted by the International Bureau.
 - c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
 - d. ☐ have not been made and will not be made.
8. ☐ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. ☐ An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10. ☐ A translation of the annexes of the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Item 11. to 16. below concern document(s) or information included:

11. ☒ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. ☒ A **FIRST** preliminary amendment.
14. ☐ A **SECOND** or **SUBSEQUENT** preliminary amendment.
15. ☐ A substitute specification.
16. ☒ A change of power of attorney and/or address letter.
16. ☒ Other items or information:

INTERNATIONAL PRELIMINARY EXAMINATION REPORT (PCT/IPEA/409)
INTERNATIONAL SEARCH REPORT (PCT/ISA/210) & 2 cited references
ABSTRACT of the disclosure on a separate sheet
APPLICATION DATA SHEET

U.S. APPLICATION NO. 09/890583		INTERNATIONAL APPLICATION NO. PCT/SE00/00113		ATTORNEY'S DOCKET NO. 980166US/II	
17. <input checked="" type="checkbox"/> The following fees are submitted: BASIC NATIONAL FEE (37 CFR 1.492(a)(1)-(5)): Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO \$ 1,000.00 International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO \$ 860.00 International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO \$ 710.00 International preliminary examination fee (37 CFR 1.482) paid to USPTO but all claims did not satisfy provisions of PCT Article 33(1)-(4) \$ 690.00 International preliminary examination fee (37 CFR 1.482) paid to USPTO and all claims satisfied provisions of PCT Article 33(1)-(4) \$ 100.00 <div style="text-align: right;">ENTER APPROPRIATE BASIC FEE AMOUNT =</div>				CALCULATIONS PTO USE ONLY	
Surcharge of \$130.00 for furnishing the oath or declaration later than 30 months from the earliest claimed priority date (37 CFR 1.492(e)).				\$ 1,130.00	
CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE	\$	
Total claims	7 - 20 =	0	X \$18.00	\$	
Independent claims	1 - 3 =	0	X \$80.00	\$	
MULTIPLE DEPENDENT CLAIMS(S) (if applicable)			+ \$270.00	\$	
TOTAL OF ABOVE CALCULATIONS =				\$ 1,130.00	
Reduction of 1/2, if applicant is entitled to Small Entity status under 37 CFR 1.27. +				\$	
SUBTOTAL =				\$ 1,130.00	
Processing fee of \$130 for furnishing the English translation later than months from the earliest claimed priority date (37 CFR 1.49(f)).				\$	
TOTAL NATIONAL FEE =				\$ 1,130.00	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). \$40.00 per property +				\$	
TOTAL FEES ENCLOSED =				\$ 1,130.00	
				Amount to be refunded:	
				charged:	
a.	<input checked="" type="checkbox"/>	A check in the amount of \$ <u>1,130.00</u> to cover the above fees is enclosed.			
b.	<input type="checkbox"/>	Please charge my Deposit Account No. 25-0120 in the amount of \$ to cover the above fees. A duplicate copy of this sheet is enclosed.			
c.	<input checked="" type="checkbox"/>	The Commissioner is hereby authorized to charge any additional fees which may be required by 37 CFR 1.16 and 1.17, or credit any overpayment to Deposit Account No. 25-0120 . A duplicate copy of this sheet is enclosed.			
<div style="display: flex; justify-content: space-between;"> <div> <p>SEND ALL CORRESPONDENCE TO:</p> <p>CUSTOMER NO. 00466 YOUNG & THOMPSON 745 South 23rd Street 2nd Floor Arlington, VA 22202 (703) 521-2297 facsimile (703) 685-0573</p> </div> <div> <p>August 2, 2001</p> </div> <div style="text-align: right;"> <p>By <u>Benoît Castel</u> Benoît Castel Attorney for Applicants Registration No. 35,041</p> </div> </div>					

09/890583

JC05 Rec'd PCT/PTO 02 AUG 2001
PATENTS

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of

Anders ECKERBOM et al.

Box PCT

Serial No. (unknown)

Application Branch

Filed herewith

LIQUID SEPARATOR
WITH HOLDER UNIT

PRELIMINARY AMENDMENT

Commissioner for Patents

Washington, D.C. 20231

Sir:

Prior to the first Official Action and calculation of the filing fee, please amend the above-identified application as follows:

IN THE CLAIMS:

Amend claim 3 as follows:

--3. (Amended) A liquid separator according to Claim 2, **characterised** in that the water trap (1) includes two connection passageways (9, 10), and in that the holder unit (2) includes two connection devices (15, 16).--

Amend claim 4 as follows:

--4. (Amended) A liquid separator according any Claim 1, **characterised** in that the holder unit (2) includes a first electric contact element (18) which functions to detect the presence of a liquid trap (1) in the holder unit and to stop the flow of sample gas to the analysis instrument when no water trap is fitted in the holder unit.--

Amend claim 5 as follows:

--5. (Amended) A liquid separator according to Claim 1, **characterised** in that the holder unit (2) includes a second electric contact element (17) which functions to detect the type of water trap (1) fitted in the holder unit and to adjust the analysis instrument in accordance with the type of water trap used.--

Amend claim 7 as follows:

--7. (Amended) A liquid separator according to Claim 1, **characterised** in that the water trap (1) is intended for one-time use only.--

R E M A R K S

The above changes in the claims merely place this national stage application in the same condition as it was during Chapter II of the international stage, with the multiple dependencies being removed.

Attached hereto is a marked-up version of the changes made to the claims by the current amendment. The attached page is captioned "VERSION WITH MARKINGS TO SHOW CHANGES MADE."

Respectfully submitted,

YOUNG & THOMPSON

By



Benoît Castel
Attorney for Applicants
Registration No. 35,041
Customer No. 00466
745 South 23rd Street
Arlington, VA 22202
Telephone: 703/521-2297

August 2, 2001

VERSION WITH MARKINGS TO SHOW CHANGES MADE

Amend claim 3 as follows:

--3. (Amended) A liquid separator according to ~~Claims 1 and Claim 2~~, **characterised** in that the water trap (1) includes two connection passageways (9, 10), and in that the holder unit (2) includes two connection devices (15, 16).--

Amend claim 4 as follows:

--4. (Amended) A liquid separator according any ~~one of the preceding Claims Claim 1~~, **characterised** in that the holder unit (2) includes a first electric contact element (18) which functions to detect the presence of a liquid trap (1) in the holder unit and to stop the flow of sample gas to the analysis instrument when no water trap is fitted in the holder unit.--

Amend claim 5 as follows:

--5. (Amended) A liquid separator according to ~~any one of the preceding Claims Claim 1~~, **characterised** in that the holder unit (2) includes a second electric contact element (17) which functions to detect the type of water trap (1) fitted in the holder unit and to adjust the analysis instrument in accordance with the type of water trap used.--

Amend claim 7 as follows:

--7. (Amended) A liquid separator according to ~~any one of the preceding Claims Claim 1~~, **characterised** in that the water trap (1) is intended for one-time use only.--

3/PRTS

09/890583
JC05 Rec'd PCT/PTO 0 2 AUG 2001
PCT/SE00/00113

LIQUID SEPARATOR WITH HOLDER UNIT

The present invention relates to a liquid separator for separating liquid from gases, and particularly for separating liquids from expiration gases in medical analysis instruments.

When a gas sample from expiration gases is led in a patient circuit to an analysis instrument, it is unavoidable that moisture, secretion, blood, bacteria, etc., are liable to accompany the sample. As the temperature falls when the gas sample is led from the patient circuit to the analysis instrument, moisture present in the gas precipitates in the form of water droplets. Should water, blood or secretion enter the analysis instrument, there is a serious risk that the instrument will be permanently damaged, and consequently various protective solutions for preventing such contamination have been proposed in the art.

The simplest method of avoiding the ingress of bacteria, blood and secretion into the gas sample is to place a hydrophobic bacteria filter in the orifice of the sampling conduit proximal to the patient circuit. One drawback with this solution resides in the difficulty of obtaining a filter surface, which is sufficiently large to prevent the rise time of the gas measuring process from being impaired. A filter that has a small surface area will quickly become blocked and therefore result in an interruption in the gas monitoring process.

The presence of a bacteria filter in the orifice of the sampling conduit will not solve the moisture problem, because the moisture does not precipitate from the sample until the

sample is downstream of the filter. One solution to this problem is to use a special hose material, Nafion®, which allows moisture to wander freely through the hose wall. This material, however, is very expensive which makes it difficult to obtain viable products when using said material.

Alternatively, water droplets, and possibly also secretion, can be separated from expiration gas in a water trap. A positive, inexpensive and effective separator can be obtained, by combining the water trap with a bacteria filter. However, one drawback with this solution is that the rise time of the gas measuring process will be seriously impaired unless the water trap is adapted with respect to the volume of gas that shall be processed at that particular time.

The need for a short rise time is particularly accentuated when measuring the expiration gas of newly born infants, e.g. neonatal patients. Small children usually have a considerably higher respiration rate than adults. 40-60 breaths per minute is normal for such infants, as compared to about 12 breaths per minute for adults. Thus, in this case the gas sampling system must have a pneumatic rise time of well above 0.5 s in order to carry out a correct gas analysis with respect to time, a rise time of 200 ms being an appropriate value in this respect.

The pneumatic rise time of the gas sampling system is essentially inversely proportional to the sampling flow, in other words a high rate of flow results in a short rise time. Respiration volumes of several litres are normal in the case of adult patients, which enables sample flow rates in the order of 200-300 ml/min to be used without influencing the respiratory circuit. However, in the case of neonatal patients,

which have respiratory volumes in the order of decilitres, it is necessary to lower the rate of flow to a minimum. 50 ml/min is a normal flow rate in this latter case. Consequently, when the need for a short rise time is greatest, the possibilities of achieving such a rise time are the worst.

In addition to needing to extract moisture, bacteria, etc., from the expiration gas of a patient, it is also necessary to protect the analysis instrument from dirt and other contaminants present in the ambient air. Many gas analysis instruments have long warm-up times, meaning that the instrument is normally never switched off. Consequently, if the instrument is left switched on for a long period of time in the absence of a protective filter, the measuring chamber of the analyser will gradually become dirty with progressively poorer performances as a result.

Water traps have been the solution that has been used to increasing extents to eliminate moisture in gas samples. EP-A2-0 549 266 teaches a method of extracting both moisture and other foreign particles with the aid of a hydrophobic bacteria filter. In the case of the water trap described in this prior publication, the gas sample is passed through a passageway that is divided in an upper half and a lower half of the hydrophobic filter. The moist gas sample is led into the front edge of the lower half of a passageway and is caused to exit by applying a strong sub-pressure to an opening in the rear edge of the upper half of said passageway. The liquid extracted by this arrangement is led away by applying a weak sub-pressure to an opening in the rear edge of the lower half of the passageway.

One drawback with this known water trap is that it requires a relatively large filter area, about 1 cm², in order to ensure that the product will have a sufficient length of life. The length of the passageway is limited chiefly by the desire to
5 obtain the smallest possible unit. A length of about 3.5 cm has been found suitable. Consequently, a passageway diameter of about 3 mm is needed in order to obtain an effective filter surface. Hoses, used for gas sampling purposes, however, will normally have an inner diameter of about 1.4-1.5 mm,
10 meaning that eddy currents are generated and impaired rise time obtained when the gas sample reaches the larger diameter of the passageway.

Accordingly, the object of the present invention is to provide a liquid separator that avoids the aforesaid drawback with the earlier known water trap.
15

This object is achieved with an inventive liquid separator that has the characteristic features set forth in the accompanying Claims.
20

There is provided in accordance with the invention a liquid separator for extracting liquid from gases, said separator comprising a water trap that includes a container, a connection for incoming gas flows, a separation chamber that includes a filter, and at least one connection passageway for conducting separated gas to an analysis instrument, wherein the water trap can be attached removably to a holder unit connected to the analysis instrument, and wherein the holder unit includes connection means for connection of the connecting passageway.
25
30

The invention also enables water traps of different sizes to be used for adults and for children, with automatic switching of the analysis instrument in accordance with the size of water trap used.

5

The invention will now be described with reference to a non-limiting exemplifying embodiment thereof and also with reference to the accompanying drawings, in which **Fig. 1** is a perspective view of an inventive liquid separator, showing the water trap and the holder unit separated from one another; **Fig. 2** is a perspective exploded view of the water trap shown in **Fig. 1**; and **Fig. 3** is a perspective exploded view of the holder unit shown in **Fig. 1**.

10

The inventive liquid separator comprises two main parts in the form of a water trap 1 and a holder unit 2. The holder unit 2 is a part that can normally be firmly fitted to the instrument (not shown) used to analyse expiration gas. The water trap 1 is a disposable product that is preferably found in two different sizes or two different designs, one for adult patients and one for neonatal patients.

20

The water trap 1 includes a container 3 located beneath a separation chamber 4 provided with a connection 5 for receiving a gas flow incoming from the patient. The separation chamber includes a liquid passageway 6 and a filter 7 positioned above said passageway, for instance a bacteria filter. Located above the separation chamber 4 and connecting to the other side of the filter 7 is an upper chamber part 8 that includes a gas passageway (not shown) corresponding to the liquid passageway 6 in the separation chamber and leading to connection passageways 9, 10 by means of which the water trap can be connected to the holder unit 2 and to the analysis

25

30

instrument respectively. The upper chamber part 8 is covered by a hood or cap 11. The separation chamber 4 is fitted externally with locking tabs 12 which enable the water trap 1 to be snapped firmly to the holder unit 2.

5

The separation chamber 4 is preferably fixed permanently to the upper chamber part 8, for instance ultrasound welded thereto. The filter 7, which is inserted between the separation chamber and the upper chamber part 8, may be of the PTFE kind and has a pore size of about 0.5 μm and may be sealed with the aid of a labyrinth seal formed in the separation chamber and the upper chamber part. The container 3 of the water trap is adapted so as to be removable from the separation chamber 4 and therewith enable liquid collected in the container to be emptied therefrom.

10

15

The holder unit 2 includes a cavity 13 in which part of the water trap 1 can be accommodated. The holder unit includes locking apertures 14 which receive the locking tabs 12 on the water trap and therewith lock the trap 1 firmly in the holder unit. Two connection devices 15, 16 are provided behind the cavity 13 for receiving the connection passageways of the water trap 1. These connection devices 15, 16 are connected to hoses passing to the analysis instrument. Two electric contact elements 17, 18 are provided in the rear edge of the cavity 13 and are activated by insertion of a water trap 1 into the cavity 13 of the holder unit 2.

20

25

30

The electric contact elements 17, 18 are adapted so that one contact element will detect the presence of a water trap in the holder unit, wherewith when the water trap 1 is removed from the holder unit 2 the contact element will function to immediately stop the flow to the analysis instrument, or will

stop said flow after a certain time delay, so that no air and possible contaminants will be sucked into the instrument and contaminate the same. The other electric contact element is adapted to detect the type of water trap inserted into the holder unit. The two different types of water trap mentioned above may be designed differently at the contact region with said other electric contact element, for instance such that when using a water trap intended for children the contact will be pressed in, while providing a water trap intended for adult patients with an aperture which will mean that said other electric contact will not be pressed in when fitting said trap. The second electric contact element will then be arranged so that when it is pressed-in by fitting a water trap intended for neonatal patients, the analysis instrument will be switched to a mode in which it operates with a lower rate of flow.

The two connection passageways 9, 10 are connected to the connection devices 15, 16 of the holder unit 2 so that both a main flow that passes from the water trap to the analysis instrument and a secondary flow that passes through the container of the water trap can be obtained.

The main difference between the two water trap embodiments is that one is intended for adult patients and has a passageway width of about 3 mm, whereas the neonatal model has a passageway width of about 1.4 mm. The smaller passageway width in the neonatal model means that the rise time will be much quicker than in the case of the adult model. In this case, the problems normally occurring with shorter product life lengths are compensated for by using a lower rate of sample flow.

Because the type of water trap used can be identified, the analysis instrument can be set automatically to choose an optimal rate of sample flow for respective models through the medium of said electric contact elements. In the case of the adult model, there is normally used a flow rate in the order of 200-300 ml/min, whereas a flow rate of about 50 ml/min is normally used in the case of the neonatal model. Switching between these flow rates can thus take place fully automatically, without the risk of a wrong setting being made manually.

10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60
61
62
63
64
65
66
67
68
69
70
71
72
73
74
75
76
77
78
79
80
81
82
83
84
85
86
87
88
89
90
91
92
93
94
95
96
97
98
99
100
101
102
103
104
105
106
107
108
109
110
111
112
113
114
115
116
117
118
119
120
121
122
123
124
125
126
127
128
129
130
131
132
133
134
135
136
137
138
139
140
141
142
143
144
145
146
147
148
149
150
151
152
153
154
155
156
157
158
159
160
161
162
163
164
165
166
167
168
169
170
171
172
173
174
175
176
177
178
179
180
181
182
183
184
185
186
187
188
189
190
191
192
193
194
195
196
197
198
199
200
201
202
203
204
205
206
207
208
209
210
211
212
213
214
215
216
217
218
219
220
221
222
223
224
225
226
227
228
229
230
231
232
233
234
235
236
237
238
239
240
241
242
243
244
245
246
247
248
249
250
251
252
253
254
255
256
257
258
259
260
261
262
263
264
265
266
267
268
269
270
271
272
273
274
275
276
277
278
279
280
281
282
283
284
285
286
287
288
289
290
291
292
293
294
295
296
297
298
299
300
301
302
303
304
305
306
307
308
309
310
311
312
313
314
315
316
317
318
319
320
321
322
323
324
325
326
327
328
329
330
331
332
333
334
335
336
337
338
339
340
341
342
343
344
345
346
347
348
349
350
351
352
353
354
355
356
357
358
359
360
361
362
363
364
365
366
367
368
369
370
371
372
373
374
375
376
377
378
379
380
381
382
383
384
385
386
387
388
389
390
391
392
393
394
395
396
397
398
399
400
401
402
403
404
405
406
407
408
409
410
411
412
413
414
415
416
417
418
419
420
421
422
423
424
425
426
427
428
429
430
431
432
433
434
435
436
437
438
439
440
441
442
443
444
445
446
447
448
449
450
451
452
453
454
455
456
457
458
459
460
461
462
463
464
465
466
467
468
469
470
471
472
473
474
475
476
477
478
479
480
481
482
483
484
485
486
487
488
489
490
491
492
493
494
495
496
497
498
499
500
501
502
503
504
505
506
507
508
509
510
511
512
513
514
515
516
517
518
519
520
521
522
523
524
525
526
527
528
529
530
531
532
533
534
535
536
537
538
539
540
541
542
543
544
545
546
547
548
549
550
551
552
553
554
555
556
557
558
559
560
561
562
563
564
565
566
567
568
569
570
571
572
573
574
575
576
577
578
579
580
581
582
583
584
585
586
587
588
589
590
591
592
593
594
595
596
597
598
599
600
601
602
603
604
605
606
607
608
609
610
611
612
613
614
615
616
617
618
619
620
621
622
623
624
625
626
627
628
629
630
631
632
633
634
635
636
637
638
639
640
641
642
643
644
645
646
647
648
649
650
651
652
653
654
655
656
657
658
659
660
661
662
663
664
665
666
667
668
669
670
671
672
673
674
675
676
677
678
679
680
681
682
683
684
685
686
687
688
689
690
691
692
693
694
695
696
697
698
699
700
701
702
703
704
705
706
707
708
709
710
711
712
713
714
715
716
717
718
719
720
721
722
723
724
725
726
727
728
729
730
731
732
733
734
735
736
737
738
739
740
741
742
743
744
745
746
747
748
749
750
751
752
753
754
755
756
757
758
759
760
761
762
763
764
765
766
767
768
769
770
771
772
773
774
775
776
777
778
779
780
781
782
783
784
785
786
787
788
789
790
791
792
793
794
795
796
797
798
799
800
801
802
803
804
805
806
807
808
809
810
811
812
813
814
815
816
817
818
819
820
821
822
823
824
825
826
827
828
829
830
831
832
833
834
835
836
837
838
839
840
841
842
843
844
845
846
847
848
849
850
851
852
853
854
855
856
857
858
859
860
861
862
863
864
865
866
867
868
869
870
871
872
873
874
875
876
877
878
879
880
881
882
883
884
885
886
887
888
889
890
891
892
893
894
895
896
897
898
899
900
901
902
903
904
905
906
907
908
909
910
911
912
913
914
915
916
917
918
919
920
921
922
923
924
925
926
927
928
929
930
931
932
933
934
935
936
937
938
939
940
941
942
943
944
945
946
947
948
949
950
951
952
953
954
955
956
957
958
959
960
961
962
963
964
965
966
967
968
969
970
971
972
973
974
975
976
977
978
979
980
981
982
983
984
985
986
987
988
989
990
991
992
993
994
995
996
997
998
999
1000
1001
1002
1003
1004
1005
1006
1007
1008
1009
1010
1011
1012
1013
1014
1015
1016
1017
1018
1019
1020
1021
1022
1023
1024
1025
1026
1027
1028
1029
1030
1031
1032
1033
1034
1035
1036
1037
1038
1039
1040
1041
1042
1043
1044
1045
1046
1047
1048
1049
1050
1051
1052
1053
1054
1055
1056
1057
1058
1059
1060
1061
1062
1063
1064
1065
1066
1067
1068
1069
1070
1071
1072
1073
1074
1075
1076
1077
1078
1079
1080
1081
1082
1083
1084
1085
1086
1087
1088
1089
1090
1091
1092
1093
1094
1095
1096
1097
1098
1099
1100
1101
1102
1103
1104
1105
1106
1107
1108
1109
1110
1111
1112
1113
1114
1115
1116
1117
1118
1119
1120
1121
1122
1123
1124
1125
1126
1127
1128
1129
1130
1131
1132
1133
1134
1135
1136
1137
1138
1139
1140
1141
1142
1143
1144
1145
1146
1147
1148
1149
1150
1151
1152
1153
1154
1155
1156
1157
1158
1159
1160
1161
1162
1163
1164
1165
1166
1167
1168
1169
1170
1171
1172
1173
1174
1175
1176
1177
1178
1179
1180
1181
1182
1183
1184
1185
1186
1187
1188
1189
1190
1191
1192
1193
1194
1195
1196
1197
1198
1199
1200
1201
1202
1203
1204
1205
1206
1207
1208
1209
1210
1211
1212
1213
1214
1215
1216
1217
1218
1219
1220
1221
1222
1223
1224
1225
1226
1227
1228
1229
1230
1231
1232
1233
1234
1235
1236
1237
1238
1239
1240
1241
1242
1243
1244
1245
1246
1247
1248
1249
1250
1251
1252
1253
1254
1255
1256
1257
1258
1259
1260
1261
1262
1263
1264
1265
1266
1267
1268
1269
1270
1271
1272
1273
1274
1275
1276
1277
1278
1279
1280
1281
1282
1283
1284
1285
1286
1287
1288
1289
1290
1291
1292
1293
1294
1295
1296
1297
1298
1299
1300
1301
1302
1303
1304
1305
1306
1307
1308
1309
1310
1311
1312
1313
1314
1315
1316
1317
1318
1319
1320
1321
1322
1323
1324
1325
1326
1327
1328
1329
1330
1331
1332
1333
1334
1335
1336
1337
1338
1339
1340
1341
1342
1343
1344
1345
1346
1347
1348
1349
1350
1351
1352
1353
1354
1355
1356
1357
1358
1359
1360
1361
1362
1363
1364
1365
1366
1367
1368
1369
1370
1371
1372
1373
1374
1375
1376
1377
1378
1379
1380
1381
1382
1383
1384
1385
1386
1387
1388
1389
1390
1391
1392
1393
1394
1395
1396
1397
1398
1399
1400
1401
1402
1403
1404
1405
1406
1407
1408
1409
1410
1411
1412
1413
1414
1415
1416
1417
1418
1419
1420
1421
1422
1423
1424
1425
1426
1427
1428
1429
1430
1431
1432
1433
1434
1435
1436
1437
1438
1439
1440
1441
1442
1443
1444
1445
1446
1447
1448
1449
1450
1451
1452
1453
1454
1455
1456
1457
1458
1459
1460
1461
1462
1463
1464
1465
1466
1467
1468
1469
1470
1471
1472
1473
1474
1475
1476
1477
1478
1479
1480
1481
1482
1483
1484
1485
1486
1487
1488
1489
1490
1491
1492
1493
1494
1495
1496
1497
1498
1499
1500
1501
1502
1503
1504
1505
1506
1507
1508
1509
1510
1511
1512
1513
1514
1515
1516
1517
1518
1519
1520
1521
1522
1523
1524
1525
1526
1527
1528
1529
1530
1531
1532
1533
1534
1535
1536
1537
1538
1539
1540
1541
1542
1543
1544
1545
1546
1547
1548
1549
1550
1551
1552
1553
1554
1555
1556
1557
1558
1559
1560
1561
1562
1563
1564
1565
1566
1567
1568
1569
1570
1571
1572
1573
1574
1575
1576
1577
1578
1579
1580
1581
1582
1583
1584
1585
1586
1587
1588
1589
1590
1591
1592
1593
1594
1595
1596
1597
1598
1599
1600
1601
1602
1603
1604
1605
1606
1607
1608
1609
1610
1611
1612
1613
1614
1615
1616
1617
1618
1619
1620
1621
1622
1623
1624
1625
1626
1627
1628
1629
1630
1631
1632
1633
1634
1635
1636
1637
1638
1639
1640
1641
1642
1643
1644
1645
1646
1647
1648
1649
1650
1651
1652
1653
1654
1655
1656
1657
1658
1659
1660
1661
1662
1663
1664
1665
1666
1667
1668
1669
1670
1671
1672
1673
1674
1675
1676
1677
1678
1679
1680
1681
1682
1683
1684
1685
1686
1687
1688
1689
1690
1691
1692
1693
1694
1695
1696
1697
1698
1699
1700
1701
1702
1703
1704
1705
1706
1707
1708
1709
1710
1711
1712
1713
1714
1715
1716
1717
1718
1719
1720
1721
1722
1723
1724
1725
1726
1727
1728
1729
1730
1731
1732
1733
1734
1735
1736
1737
1738
1739
1740
1741
1742
1743
1744
1745
1746
1747
1748
1749
1750
1751
1752
1753
1754
1755
1756
1757
1758
1759
1760
1761
1762
1763
1764
1765
1766
1767
1768
1769
1770
1771
1772
1773
1774
1775
1776
1777
1778
1779
1780
1781
1782
1783
1784
1785
1786
1787
1788
1789
1790
1791
1792
1793
1794
1795
1796
1797
1798
1799
1800
1801
1802
1803
1804
1805
1806
1807
1808
1809
1810
1811
1812
1813
1814
1815
1816
1817
1818
1819
1820
1821
1822
1823
1824
1825
1826
1827
1828
1829
1830
1831
1832
1833
1834
1835
1836
1837
1838
1839
1840
1841
1842
1843
1844
1845
1846
1847
1848
1849
1850
1851
1852
1853
1854
1855
1856
1857
1858
1859
1860
1861
1862
1863
1864
1865
1866
1867
1868
1869
1870
1871
1872
1873
1874
1875
1876
1877
1878
1879
1880
1881
1882
1883
1884
1885
1886
1887
1888
1889
1890
1891
1892
1893
1894
1895
1896
1897
1898
1899
1900
1901
1902
1903
1904
1905
1906
1907
1908
1909
1910
1911
1912
1913
1914
1915
1916
1917
1918
1919
1920
1921
1922
1923
1924
1925
1926
1927
1928
1929
1930
1931
1932
1933
1934
1935
1936
1937
1938
1939
1940
1941
1942
1943
1944
1945
1946
1947
1948
1949
1950
1951
1952
1953
1954
1955
1956
1957
1958
1959
1960
1961
1962
1963
1964
1965
1966
1967
1968
1969
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035
2036
2037
2038
2039
2040
2041
2042
2043
2044
2045
2046
2047
2048
2049
2050
2051
2052
2053
2054
2055
2056
2057
2058
2059
2060
2061
2062
2063
2064
2065
2066
2067
2068
2069
2070
2071
2072
2073
2074
2075
2076
2077
2078
2079
2080
2081
2082
2083
2084
2085
2086
2087
2088
2089
2090
2091
2092
2093
2094
2095
2096
2097
2098
2099
2100
2101
2102
2103
2104
2105
2106
2107
2108
2109
2110
2111
2112
2113
2114
2115
2116
2117
2118
2119
2120
2121
2122
2123
2124
2125
2126
2127
2128
2129
2130
2131
2132
2133
2134
2135
2136
2137
2138
2139
2140
2141
2142
2143
2144
2145
2146
2147
2148
2149
2150
2151
2152
2153
2154
2155
2156
2157
2158
2159
2160
2161
2162
2163
2164
2165
2166
2167
2168
2169
2170
2171
2172
2173
2174
2175
2176
2177
2178
2179
2180
2181
2182
2183
2184
2185
2186
2187
2188
2189
2190
2191
2192
2193
2194
2195
2196
2197
2198
2199
2200
2201
2202
2203
2204
2205
2206

CLAIMS

1. A liquid separator for separating liquid from gases and comprising a water trap (1) that includes a container (3), a connection (5) for incoming gas flow, a separation chamber (4) that includes a filter (7), and at least one connection passageway (9, 10) for leading liquid-free gas to an analysis instrument, characterised in that the water trap (1) can be removably fitted in a holder unit (2) connected to the analysis instrument; and in that the holder unit (2) is provided with connection devices (15, 16) for accommodating the connection passageway (9, 10).
2. A liquid separator according to Claim 1, characterised in that the connection device (15, 16) is a quick-fastener device for connection to the connection passageway (9, 10).
3. A liquid separator according to Claims 1 and 2, characterised in that the water trap (1) includes two connection passageways (9, 10), and in that the holder unit (2) includes two connection devices (15, 16).
4. A liquid separator according to any one of the preceding Claims, characterised in that the holder unit (2) includes a first electric contact element (18) which functions to detect the presence of a liquid trap (1) in the holder unit and to stop the flow of sample gas to the analysis instrument when no water trap is fitted in the holder unit.
5. A liquid separator according to any one of the preceding Claims, characterised in that the holder unit (2) includes a second electric contact element (17) which functions to detect the type of water trap (1) fitted in the holder unit and

to adjust the analysis instrument in accordance with the type of water trap used.

6. A liquid separator according to Claim 5, characterised in
5 that the water trap (1) is designed in different sizes for infants and adults; and in that one size includes means for actuating the second electric contact element (17) of the holder unit.

10 7. A liquid separator according to any one of the preceding Claims, characterised in that the water trap (1) is intended for one-time use only.

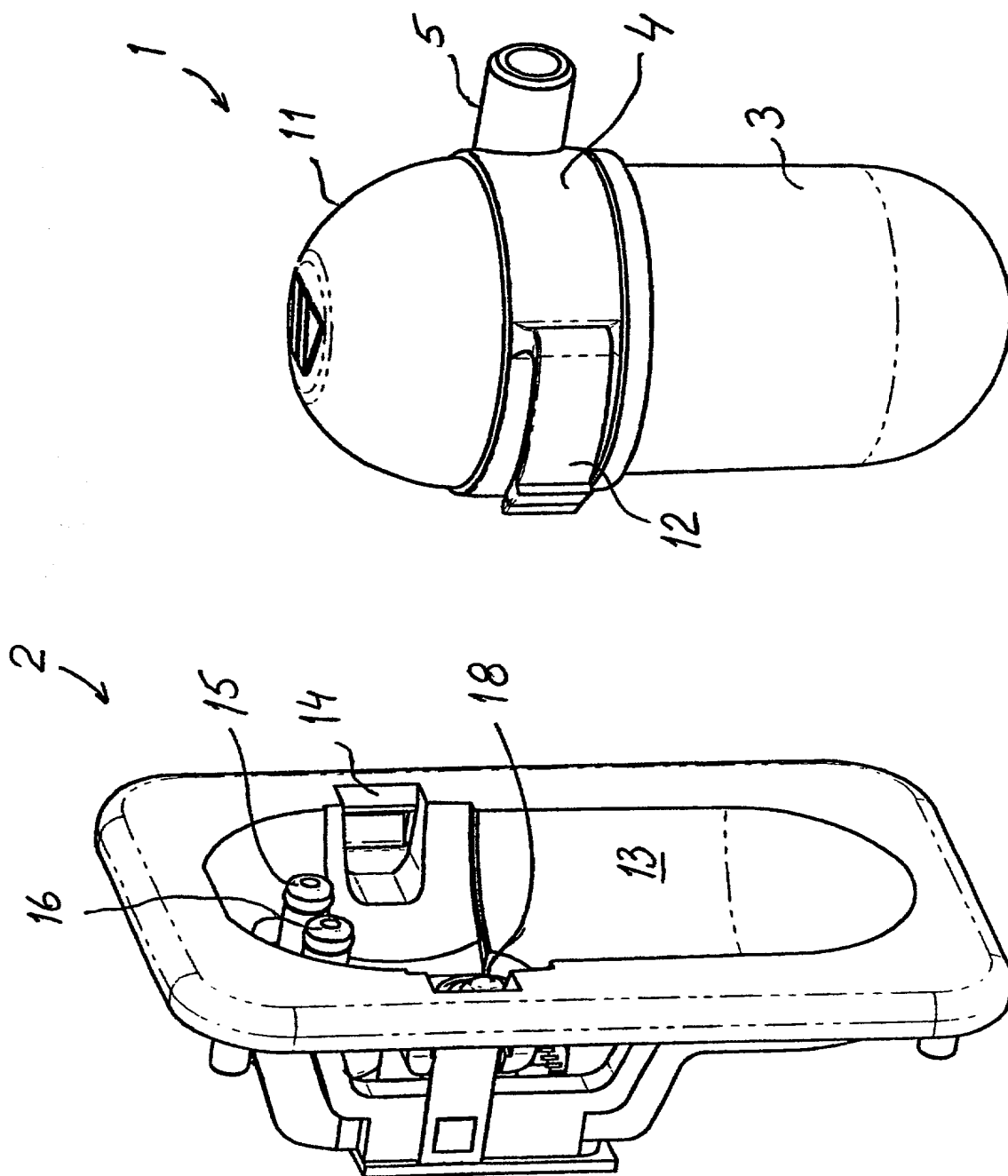


Fig. 1

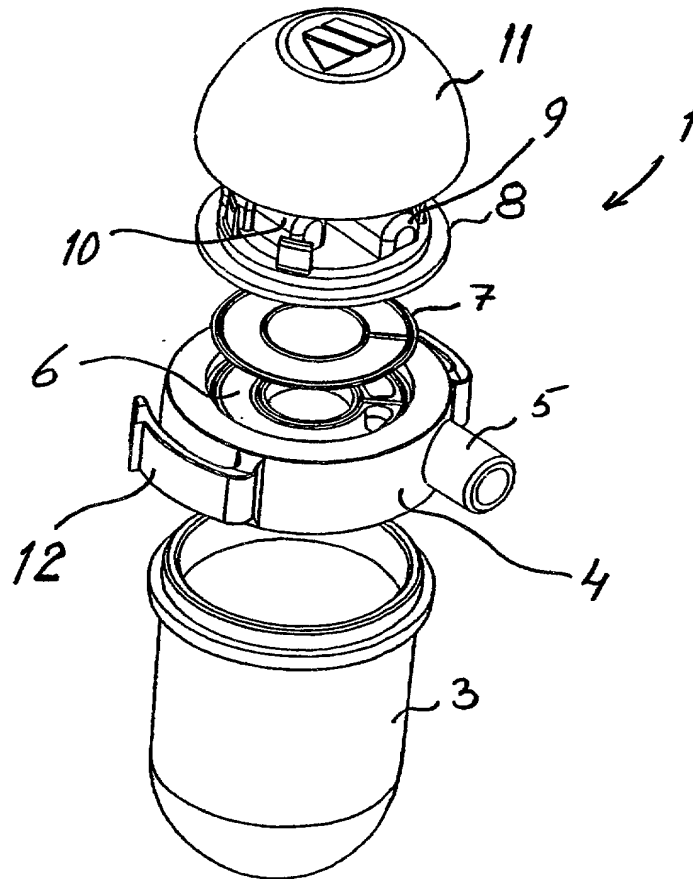
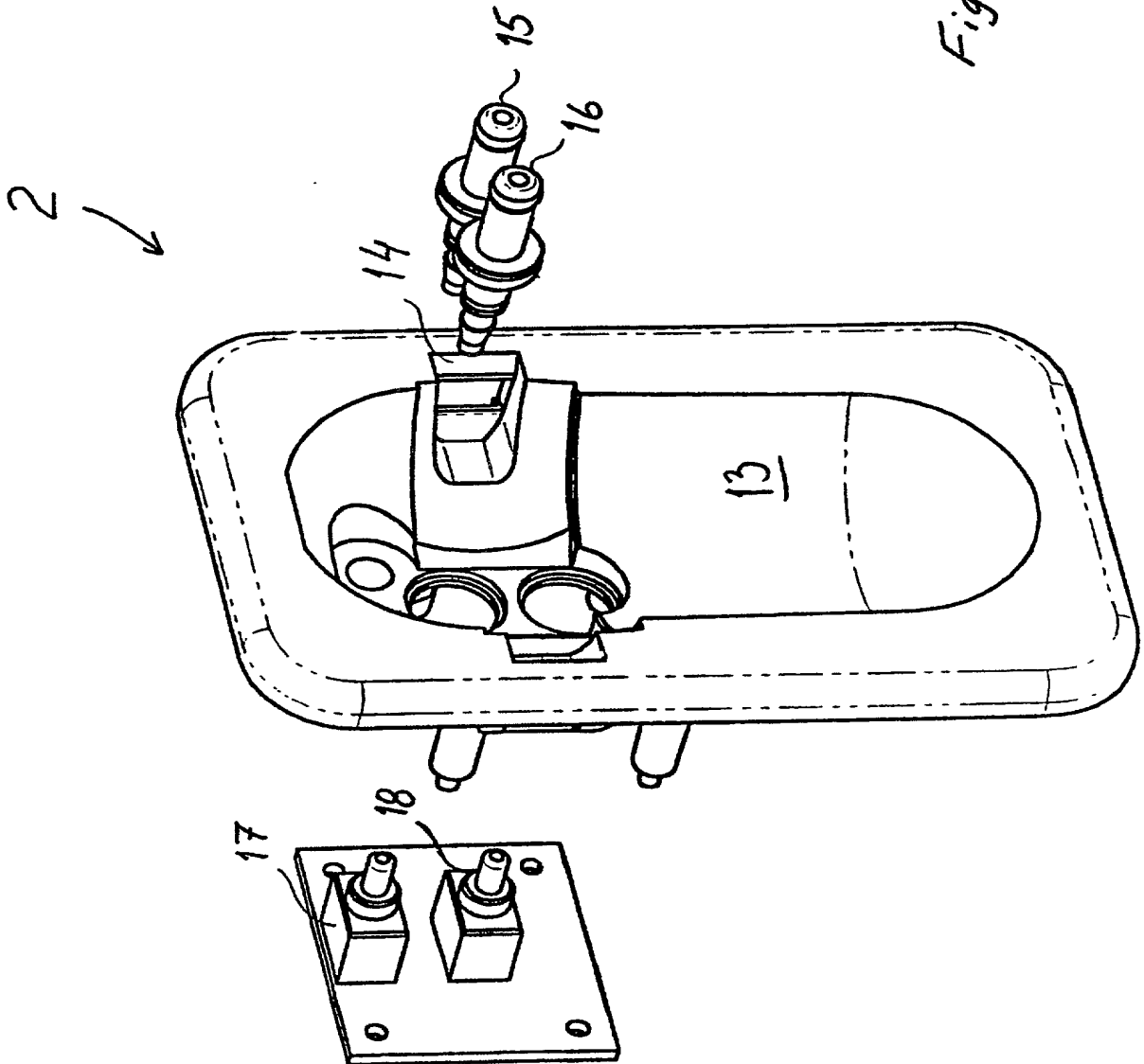


Fig. 2

89/000585

Fig. 3



COMBINED DECLARATION AND POWER OF ATTORNEY

As a below named inventor, I hereby declare that

My residence, post office address and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

LIQUID SEPARATOR WITH HOLDER UNIT

the specification of which: *(check one)*

REGULAR OR DESIGN APPLICATION

☐ is attached hereto.

☐ was filed on _____ as application Serial No. _____ and was amended on (if applicable).

PCT FILED APPLICATION ENTERING NATIONAL STAGE

☒ was described and claimed in International application PCT/SE00/00113 filed on 20 January 2000 and as amended on (if any).

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, §1.56.

PRIORITY CLAIM

I hereby claim foreign priority benefits under 35 USC 119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed.

PRIOR FOREIGN APPLICATION(S)

Country	Application Number	Date of Filing (day, month, year)	Priority Claimed
Sweden	9900351-9	2 February 1999	yes

(Complete this part only if this is a continuing application.)

I hereby claim the benefit under 35 USC 120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of 35 USC 112, I acknowledge the duty to disclose information which is material to patentability as defined in Title 37 Code of Federal Regulations §1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application:

(Application Serial No.)

(Filing Date)

(Status--patented, pending, abandoned)

POWER OF ATTORNEY

The undersigned hereby authorizes the U.S. attorney or agent named herein to accept and follow instructions from Norens Patentbyrå AB as to any action to be taken in the Patent and Trademark Office regarding this application without direct communication between the U.S. attorney or agent and the undersigned. In the event of a change in the persons from whom instructions may be taken, the U.S. attorney or agent named herein will be so notified by the undersigned.

As a named inventor, I hereby appoint the registered patent attorneys represented by Customer No. **000466** to prosecute this application and transact all business in the Patent and Trademark Office connected therewith, including: **Robert J. PATCH**, Reg. No. 17,355, **Andrew J. PATCH**, Reg. No. 32,925, **Robert F. HARGEST**, Reg. No. 25,590, **Benoît CASTEL**, Reg. No. 35,041, **Eric JENSEN**, Reg. No. 37,855, **Thomas W. PERKINS**, Reg. No. 33,027, and **Roland E. LONG, Jr.**, Reg. No. 41,949,

c/o YOUNG & THOMPSON,
Second Floor,
745 South 23rd Street,
Arlington, Virginia 22202.



00466

PATENT TRADEMARK OFFICE

Address all telephone calls to Young & Thompson at 703/521-2297. Telefax: 703/685-0573.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Full name of sole or first inventor: Anders ECKERBOM
(given name, family name)

Inventor's signature

Date

010814

Residence: Vaxholm, Sweden

SEX

Citizenship: Swedish

Post Office Address: PI 669

S-185 41 Vaxholm, Sweden

Full name of second joint inventor, if any: Per LINDESTAM
(given name, family name)

Inventor's signature

Date

010814

Residence: Jarfalla, Sweden

SEX

Citizenship: Swedish

Post Office Address: Bolindervagen 113

S-176 54 Jarfalla, Sweden